

THE PROCEEDINGS *of* THE INSTITUTION OF PRODUCTION ENGINEERS

The Official Journal of the Institution of Production Engineers

Members are requested to correspond with the Editor upon matters of general interest. Letters may take the form of descriptions of unusual plant or tools, workshop methods, production problems, or organisation systems. Only in exceptional circumstances will proprietary articles be dealt with editorially. Manufacturers wishing to draw the attention of the Institution to the merits of their products are invited to use the advertisement columns of this Journal. Correspondence should be addressed as follows:

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Discussion on Mr. E. C. Gordon England's Paper entitled "The Conservation of Human Effort in Industry."

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MR. GERARD SMITH, in the Chair, in opening the discussion, said that they had had a very interesting paper from what he thought would be a new point of view to many of them. Those members who were not already works managers hoped to be at no very distant date, and when they were put in control of a complete works, the human element, as Mr. Gordon England had pointed out, was a very important factor, perhaps the all-important one. It was possibly new to many of those present that the manufacturing or supplying of commodities to the community in general could not help but be accompanied by profit. Many of us were struggling for that happy accompaniment, and again, of course, many of us lose everything else in the view that the profits are the be all and end all of industry. However, it was not his purpose to do any talking himself, as Mr. Gordon England had thrown out a challenge to the meeting and was waiting to be tackled. He suggested that the members should do so.

Mr. C. TOFIELD, a Visitor, said that he did not wish to question Mr. Gordon England because he was quite in sympathy with the ideas that he had been expounding. There was one phase, however, which he thought should be emphasised, and that was the necessity for teaching the younger members of the profession. There was no doubt that that was one of the greatest lessons which production engineers had to learn. There were, of course, many books published on such subjects as time study, human conditions in factories, etc., and he thought that the best thing was that those who were familiar with right conditions and tried to practise them, should pass on to young men and juniors the names of books where could be found reliable information on these subjects. Probably Dr. Taylor, the American, was the first to apply such conditions to workshop practice, and there were also a brother and sister named Gilbreth who had devotedly added much literature to the subject. He appreciated all that Mr. Gordon England had said.

Mr. E. W. HANCOCK, Member of Council, said that he had listened with appreciation to Mr. Gordon England's paper, and, far from criticising, he would do all he could to support the majority of his views. The question that interested him most at the moment was the training of the young mind. For this it was necessary to have instructors, and it seemed to him that they were faced with the difficulty of training instructors. Since they were dealing with the human point of view, one of the best ways of obtaining trained instructors was by means of personal contact. Some form of travel in this country or abroad, preferably in this country, was desirable so that these men, who were to instruct juniors, should be able to discuss useful points with their equals, seniors, and juniors in other walks of life. This was a point which he had often encountered, as the average works in this country did not allow their middlemen and production engineers sufficient opportunity to travel and so come into contact with other people similarly placed in different factories. There were many men quite capable in that they know their own subject, but it was often very difficult for them to "put it over." At a meeting like the present one it was sometimes very difficult for a man to say exactly what he thought, but it occurred to him that if facilities were given to travel and make contact it would benefit greatly those whose work it was to instruct the juniors. It would also be one step towards the very laudable objects that Mr. Gordon England had in view.

The reference to limitations to the duties of various members of the staff rather amused him. It was very difficult for a man, especially a young man, to define exactly his responsibilities and relationships to those above and below him. Young men in particular are all very anxious to do their utmost, but if they were

tied up by all sorts of rules and regulations and just left off short, so to speak, for a few times, they began to get bad. There was no doubt that if the functions of each member of the staff could be fairly laid down, better results would be obtained all round. This again involved a knowledge of human nature, and he thought the whole question reverted to nature.

Taking a more tangible example of modern methods of machining and producing, the most modern methods that he knew were analogous to a river starting from a little spring, fed by its tributaries and finally flowing into the sea. A motor car might be taken as an example. This was started with a cylinder block casting, and finished up on a chassis line with all the subsidiary lines striking the main line at the required point. If the production of a motor car is planned on those lines, *i.e.*, on a parallel with nature, the saving which can be effected in the handling of material alone, apart from the conservation of human effort, is remarkable.

Mr. Gordon England had referred to human beings rather than to machines. He thought this was, or should be, the basis of constructive thinking on the part of production engineers. The modern machine tool was designed with the sole purpose of conserving human effort, so that in selecting the most modern plant we were automatically conserving human effort.

MR. GORDON ENGLAND, in reply to previous speakers, said that the Chairman in referring to profits had rather assumed that profits were inseparable from industry, inasmuch as, unless a firm were making a profit they were not doing any good, and would very shortly be eliminated from the field if they did not get on to a profitable basis. He had not intended to say that it was impossible to go wrong. Obviously, one could only be sure of a profit if one were efficient. There was no other way of making profit. His suggestion was that enormous profits were to be made by being efficient in industry, and by saving the human element in every possible way. That was his point with regard to profits.

Mr. Tofield had said that he agreed with the training of young people. He felt sure that everybody who thought seriously of this question would agree, and he thought possibly the very best thing to be done was to appoint a man who had the educational type of mind to look after the younger generation of engineers. As a case in point, he might perhaps quote an experiment he was trying out himself at the moment. He was very keen on teaching apprentices, and had come to the conclusion that what was required was a man with a scholastic mind to teach apprentices because he was able to convey information where other people could not. It was a specialised branch of work and called for an expert. As a matter of fact the man he had eventually

selected for the work was a retired colonel who was well used to training men in the army. He had the knack of being popular, with a nice easy manner, and he had very good educational ideas. He was also a very good amateur mechanic, and it would perhaps cause surprise to hear that as soon as he entered the works they found he was a wonderfully efficient engineer. He had to observe all sorts of processes, and in a short time he found many things which could be improved. The question of obtaining the right teacher was an important one, as Mr. Hancock had said, and he thought that teachers would get a great deal out of an interchange of ideas. He thought one of the best ways of dealing with instructors was to get them to join such movements as the Oxford lectures. These covered every phase of industry, and papers were given on almost every subject within the sphere of human effort in industry, and, of course, the great thing was the discussion which followed.

Mr. Hancock had referred to the point he had stressed of too many rules and regulations surrounding people and their duties. These old-fashioned ideas are rampant in all the Forces, in the Civil Service, and include the old idea that promotion went by age, which was the basic trouble. Everyone as he gets older has a tendency to get into this groove, and to be resentful when people come along and teach them something. In fact, he thought that some of these ideas are subconscious, including the tendencies to surround certain duties and functions with a mass of regulations. It amounted to a form of protection for the older people against promotion of the younger people according to capabilities.

He was entirely in agreement with Mr. Hancock's idea of handling material in order to save human effort. The river system which Mr. Hancock had so admirably used as an analogy was undoubtedly the one which everybody would have to accept. At first sight one was inclined to kick at the idea, and he, personally, was just in the position of having to move into an entirely new works, where he was going to try to short-circuit every possible movement of material, with the idea of cutting down handling to the utmost limit. The Austin Company had done this, and the Ford Company in America. It was also his idea to try to eliminate stores as far as possible, which, in his opinion, was conserving human effort. The people employed in handling stores were entirely unnecessary, and if their duties could be avoided the same men could be put on production work, and one could afford to pay them more money. If labour could be saved by using automatic machinery it was all to the good. For certain parts production could be made fully automatic, so that one man could probably look after half a dozen machines with ease. This principle could not be taken so far in other directions, although much could be done in the class of duties ordinarily assigned to labourers. For example, in sweeping up

shops, this could be done in certain cases entirely by machinery. He personally was so hedged in with restrictions by the L.C.C. that he could not do what he wished to do in this respect, but he regarded the man who was sweeping up the woodworking shop as entirely wasting labour which could be transferred to some productive job. There was another class of work, namely, the clerical work involved in keeping unnecessary records, which offered scope for the conservation of human energy. He thought the tendency was to regard a job only in its elemental parts. This received adequate attention, and parts were made efficiently by machinery, but insufficient attention was paid to the assembling and movement of the parts and the work associated with these processes.

MR. WILLMOTT, Member, said he thought they all appreciated Mr. Gordon England's efforts in giving a paper on such a vast subject, condensing it and presenting it in such an understandable form. Unfortunately, the paper was one that, although it could be applied to the sphere of work of a production engineer, had dealt very little with the production side directly. In the conservation of human effort in industry generally Mr. Gordon England had laid down very clear principles. There were one or two points in the paper which might, perhaps, be emphasised, but he had heard very little that could be contradicted. The vital point, however, was touched by the Chairman when he mentioned the question of profits. Industry really existed on a profit basis, and all these things which they quite agreed were necessary had to be paid for. When any such improvement came before the board of management the invariable question is: "Where is the money to come from to pay for it?" In reply to the question "What is it going to cost?" one had to prove that a reduction in cost or an economy could be effected which would pay for the proposed improvement, otherwise the idea might as well be put in the waste-paper basket.

Instructors were very necessary, but in this, as in welfare work, everything depended on the choice of a suitable individual for the conditions.

There was another point which Mr. Gordon England had mentioned, namely, the capital value at which the human machine should be assessed. He had not seen or heard this point discussed, but he had taken a certain amount of interest in the matter, even to the point of working out figures for different classes of labour, say a machine tool-maker against a bench tool-maker. He had also worked out the capital value of the machine-shop foreman, and could give a definite figure regarding the cost of changing a machine-shop foreman in a certain firm. In the case which he had in mind the change was made against his wishes, although he was able to obtain a better man, but even so the change cost a very considerable amount. He was not quite sure if the figure which Mr. Gordon England had mentioned was £12,000, but he thought it was rather

high. Also, he did not know whether this was an average figure for machine-shop operators, tool-makers, etc., or whether it included responsible officials.

Although Mr. Gordon England had spoken disparagingly about semi-sentimental welfare work, most of the suggestions in the paper came more or less under the welfare department. He would like to suggest that as the word "Welfare" had rather an unpleasant savour to many practical men, it should be changed to the word "Service." He had adopted this term, and thought that the word "Service" covered the work very much more effectively, and also carried with it a little more authority.

Towards the end of the paper the matter of apprentices had been mentioned, and he would like the author to stress that point a little more, because he regarded it as the crux of the whole matter. The apprentices of to-day were the responsible human labour of the future, and every bit of instruction that was put in to-day would yield a return later. Unfortunately, the matter of apprentices had to be tackled in a different manner, because they found that apprentices were being interfered with by the Unions, and he thought on this point employers would have to take a very strong stand.

He certainly agreed that promotion should go by results, and with reasonable care and an intelligent interest in the human material with which one was surrounded, mistakes need not be made in that respect. In the works to which he had previously referred there were about 24 foremen, out of which, over a period of 12 years he had promoted 22. He never went outside the works for a single man, and he and everybody else were quite satisfied. Promotion by results was just as necessary as payment by results.

MR. GORDON ENGLAND, replying to Mr. Willmott, said that on the question of profits he thought they were still a little bit at variance. Mr. Willmott suggested that the things that he had mentioned in the paper as being desirable would cost money and would presumably cut into the profits. His submission was that they would increase profits all the way through.

The point of view of the management towards such schemes was mentioned by Mr. Willmott himself, inasmuch as he said it was necessary to prove that they should show a dividend. After all, he thought that any man in control of finance would be very easily converted if he could be shown that by putting a capital sum into a specific operation or plan he could definitely get a higher percentage return than with the existing methods.

On the question of obtaining better conditions for workpeople, he could best illustrate this by referring to the works of a personal friend who was in an entirely different line of business. He had been working on the lines described in the paper, although he was not bound by the question of production costs as much as by the quality of the finished work. His object was to produce an artistic

article which would command its own market if it were sufficiently good. Although he need not worry unduly about efficient production methods he took a keen interest in them, and he had found that in almost every problem he had tackled so far, with the object of improving production methods, he was really dealing with the conservation of the human element. For example, in the case of a number of girls who were working on tapestries, and who had to use their eyes continuously, he found that output could be increased by having a rest period every ten minutes. Careful tests were taken on several of the girls, which proved that by making them stop for two minutes at the end of every ten minutes an increase of as much as 50 per cent. was obtained. At the present time they had a definite signal to mark the rest intervals, and the girls were instructed to look away from their work. This was a definite, though simple, little instance which had proved its value in pounds, shillings and pence. Surely it was up to production engineers to analyse such matters and be sure of the facts, so that they could go to the board of management and put up the figures. If it could be shown to be profitable in pounds, shillings and pence there would be little difficulty. Anything that was right and efficient was profitable.

With regard to the capital value of men, the figures which he had quoted were not his own. He had taken a high figure because this included the capital expended in education as well as other matters, and represented the national value of an individual. The figure, therefore, represented the total amount of capital that was presumably sunk in the average man throughout the country, and the question of the money spent on education could not be neglected.

He was all in favour of changing the word "Welfare" to "Service," and thought it an excellent idea. That was what the work should be. He was not scoffing at sentiment. As a matter of fact he was a great sentimentalist, but the proposition he always put forward was that although nothing should be done on sentiment, out of every right and proper action in business good sentiment resulted. The aim should be to secure a good square business deal; then, he thought, the right sentiment would be there automatically. He did not want to give the impression that he was a cold calculating fiend. Nothing was further from his nature.

With regard to apprentices, Mr. Willmott had asked for further information. As a matter of fact, that was his own pet hobby, and he had been afraid to start on it in the paper in case he had taken up too much time. However, he visualised an apprenticeship scheme and had tried to carry it out in his own works as follows: His main idea was that no boy should be taken into a works and put into a blind alley occupation. They had to appre-

ciate that the boy of to-day was the man of to-morrow, and the most valuable unit in industry. He could have a very great influence for good or evil in the matter of propaganda. At the present time he was endeavouring to evolve an apprenticeship scheme which would train the boy in every department of the works. Apprentices should have an all-round knowledge of the office and the works in order to get them to see all sides of the business. People as a rule saw only one side, and the more they could be given a balanced view the less trouble there would be. The less drive that was put on people the more they would be led, and they would naturally work along the lines required if they knew what they had to contend with. With this in view he was very strongly in favour of letting his employees see everything, and there were no secrets in his business. Actually there were no such things as secrets in business; these were largely products of one's imagination. In his own firm the instruction was to be done under the colonel he had referred to previously, and he was responsible for receiving weekly reports from each shop superintendent on every apprentice; he was also responsible for issuing to parents a monthly report of the boys' behaviour, and to the management a general report on each boy's conduct every month, so that the worth-while boys should be observed and encouraged. He believed that an apprentice should be encouraged in a practical way. His scheme, therefore, embodied making some differentiation of rates amongst apprentices so that a good mark meant 6d. a week extra. The idea was that every boy should feel that his value was appreciated and that he was making progress. This had the effect of ingraining the idea into a boy that if he worked well he would be paid well. In addition, he was very keen on the technical education of apprentices, and they were arranging for their boys to have a comprehensive system of mental training as well as training at the Polytechnic. They insisted on apprentices going in the firm's time as a portion of their training. He regarded this as a good investment. Another thing that he felt was that if a boy were trained in every possible department he would never be out of work, and the labour in the works would be fluid. To replace a man it would not be necessary to get another man from outside who had to go all through the training again.

The question of getting over the trouble with Unions and their interference with apprentices was a very difficult point. He held very strong views on this matter, and usually dealt with it by appealing to the personal feelings of those concerned. For example, he pointed out the responsibility which they all had for the boys and asked how it was proposed to deal with them unless they were taken into the trade. If a man had two sons, what was he going to do with them? If he had four, what percentage of dilution would they agree to? Did they propose to neglect their

responsibility to their sons and say, "This or that man had a surplus of sons and they must go out and be golf caddies." He thought that if the position was put before the Union officials logically they would gradually come round to the right point of view.

With regard to promotion by results, he had found a system of staff bonus on production wonderfully helpful. In their own case all the staff were on a system of payment by results on production so that the efficient member of the staff was pushed ahead by his fellows because the more he did in the way of effective administration the more they got themselves. This was working in their own case, and it could be applied in a much better way than they had been able to do so far.

Another idea which they had tried was to advertise in the works staff vacancies when these occurred, together with the rates of pay offered irrespective of what the jobs might be. This gave those in the works the idea that the firm were anxious to give them a chance and had been helpful on several occasions.

MR. MANTELL, Member, said he was very pleased to note that, in replying to some of the points which had been raised, Mr. Gordon England spoke always of transferring labour to another sphere when it had been cut out in another direction. It would be agreed that one of the biggest obstacles in the way of introducing new methods in a shop, to facilitate cheap production, was the natural feeling that they would lead to unemployment. This feeling could be overcome by pointing out that ultimately there would be development in every trade. To-day, for instance, many more people were employed although a considerable advance had been made in labour-saving equipment, and commodities themselves were very much cheaper. One of the best suggestions made for smoothing down the very natural opposition to modern methods was that each industry should create an insurance fund which could be drawn on when a firm was not large enough to keep a displaced man on the pay roll until he could again be profitably employed.

In his paper Mr. Gordon England had mentioned motion study, and he had also referred to environment. Motion study was taken up very quickly some years ago, and was dropped almost as quickly, probably because most people found it had not paid. Beyond paying attention to the obvious, there were some things which were done in the shops which struck one as being totally wrong, but to go into detail in motion study was to overlook another point which Mr. Gordon England had raised, *i.e.*, the question of environment. Men over 30 years of age, or even younger, had acquired a certain way of doing things. Take, for instance, the Chinese: they could not lift a load on to their own shoulders. They tied the load to a pole and then other people

lifted the pole on to their shoulders. That possibly was an exaggerated illustration of the conditions with which we were faced, but illustrated the problem. He did not think that human beings were quite machines in the sense that they could be standardised in their methods of applying their efforts.

On the question of welfare work, he did not think Mr. Gordon England meant welfare work in the sense that was usually associated with that term. Some time ago he had seen a piece of doggerel verse in an American paper. He could not remember the whole of it, but it was supposed to be the outspoken words of a workman, and it wound up with "Put it in the pay envelope, boss." He thought that if employers did that it would cut out the necessity for quite a lot of welfare work.

Quite early in the paper Mr. Gordon England patted production engineers on the back, and mentioned the sins he was placing at the door of the industry. Not one of them rested with the production engineer, and then he said, in essence, "Look here, you fellows, if you go to the board and say, 'This is going to put pounds, shillings, and pence in your pocket,' you will get what you want." He agreed that if any plan is reduced to its financial basis other difficulties are more easily overcome. This money is usually found out of the earnings, when it should be charged up to the capital account. If there is not enough money, fresh money should be raised and put into plant, which he assumed covered sanitation, lighting, and ventilation.

MR. GORDON ENGLAND, replying to Mr. Mantell, said he had raised a big problem in the question of what to do with displaced men. He could not honestly say that he had found a solution to it, but in their own case they had tried to overcome the difficulty on the following lines: They asked themselves whether it was possible to effect sufficient saving when they displaced a man to enable them to employ that man profitably elsewhere. In other words, general production should go up as a result of improved methods, so that immediately or in a very short time the man could be reabsorbed. The question then is whether it is possible to tide over the actual lag between displacing a man and reabsorbing him; and they had not yet really got down to a solution of that problem. He believed that it would pay to keep such men on their hands over the period between displacement and automatic reabsorption. The idea was not new, as Ford, amongst others, had stressed it emphatically and proved it to be workable. When once a principle of this kind was accepted people started to apply it wholesale. The whole difficulty was in convincing a board of management that it would pay them to carry a surplus number of men for a fortnight, three weeks, or a month, as their anxiety was that it would reduce their profits.

The whole matter was a question of very careful accountancy

research, because all the facts must be taken into consideration. It seemed to him logical, and he was going to try to prove it right in their own case. If they could prove it, that would encourage someone else to try the same thing, and a feeling of confidence would be established in the workpeople. He suggested that production engineers might apply the principle to their own work. Someone had to do pioneer work, and the workpeople would soon follow it up if they found it satisfactory.

Mr. Mantell asks if motion study pays, or does it hinge about the question of environment? He thought the trouble with motion study was that somebody had an idea and then forgot that an idea, however good it may be, requires practical application. Unfortunately, it is lauded up to the skies; motion study will do everything: it will cure all the troubles in industry, and so people start applying it because the propaganda is very good. They then find it is not as good as it ought to be, probably because of unskilled application. Reaction sets in, and the whole thing is condemned. He suggested that motion study is very useful if properly applied, and he is applying it where he can. Several of his friends are applying it in quite different lines, and some of the results obtained from it are extraordinary. Quite recently one friend decided to have a motion study by camera from positions all round the operator. The real difficulty there was to overcome the self-consciousness of the operator and to get him to enter into the spirit of the idea, but they got the results they wanted, and they had a photographic record which was useful in the extreme. He thought the whole thing was to get people to accept the idea, and he did not think that the man of thirty is too hard in his physical make-up to apply himself to better methods, but that the trouble with a man of that age is that you cannot teach him anything.

Mr. Mantell raised the question of capital expenditure for the improvements. Several people say these things should come out of capital. He felt absolutely convinced these things will not come out of capital expenditure, but out of revenue. Capital comes automatically through the savings which are effected. In other words, a saving realises capital, and surely some of the finest examples are provided by some of the American motor car manufacturers. If a record is taken of what they are doing, it will be seen that they have not put new capital into their businesses. One of the most amazing cases is the Hudson Essex. They have grown entirely out of their savings, and that is where we in this country have got a lot to learn. We always want to get fresh capital into our business. We are not quick enough in applying better methods, getting costs down on production, and he would like to suggest that we are making a fundamental error. Taking the case of the Hudson Essex people: they built up an enormous business, and

then started in on a new line with their new body works, which needed new capital expenditure. They had created such enormous reserves that they built these new body works by drawing on them, but I think in this country we always want to put fresh capital into a business when we ought to try to do it out of profits. He honestly felt that we ought to try to do this, and thought most of the things would pay for themselves without new capital.

MR. MANTELL sought permission to say more about the capital question, and continued: We are faced in England to-day with a tremendous number of engineering firms of good reputation and very poor bank balances. If they are asked to do these things out of capital, however ideal the arrangements might be, they turn round and say, "We have not got the money to do it with." He saw that nearly every day in his own business experience. People will agree that a certain procedure is going to have a lot of money, will earn a lot of money, but they have not the money or the savings to invest, and so they go on getting deeper into the mire. Their foreign competitors earn the profits, and can afford to pay for the improvements, but we in England are faced with the definite fact that earnings are very small. Some years there have not been any earnings, and any small earnings that are made have to go to satisfy impatient shareholders who have probably been in a bad boat themselves through lack of dividends. Perhaps it was a weak policy for a board of directors to pursue, but they felt that they have to give the shareholders something to go on with after all the lean years. Therefore, to get on a footing with their competitors, to put in better ventilators, better lighting, and better conveyors, which are going to earn them profits, they have got to get money from somewhere, and in the present state of industry the only way to do that is to capitalise that charge and raise fresh money. He could not claim to be a financier, but the best way would probably be by redeemable debenture, so that it could be paid off out of the profits which would accrue. If a loan is raised by the method of debenture, it is repaid out of profits, and does not add to the original capital of the company. However ideal a system may be, fresh money has to be found from somewhere to install it if profits are non-existent at the moment.

MR. A. WILLMOTT, Member, then reverted to the subject of motion study. He said that Mr. Gordon England rather took the ultra aspect of motion study, and thought that from a practical point of view, and, as it applied to the production engineer, motion study by stop watch is the one which those present were thinking of rather than the photographic method, which is rather an ultimate idea of it. He himself had worked motion study with a stop watch and had had a man specially on it. He had had a chart drawn up and went with a stop watch to see the exact time,

down to seconds, which was spent between the actual cutting operations and the motion between two cutting cycles, and each operation had been charted out in that way. That type of motion study is particularly useful to the production engineer, and he thought that that is what production engineers ought to go for in their methods in the shops.

MR. N. GERARD SMITH interposed to remark that there are two things, time study and motion study.

MR. E. W. HANCOCK, Member of Council, mentioned in connection with the question of profits, that reference had been made to one or two American factories. Perhaps one or two observations he had made this year in America might be of interest. In speaking of highly productive machines it was imagined that the great producers of America used these machines everywhere. One of the first things that struck him in going into one of the production shops at the Buick plant was the apparently old-fashioned machinery. He remarked on it, and had replied, "We are making profits, and out of them we shall put in better machinery, and we shall not put it in until we are ready for it." It struck him at this particular plant, and he saw it in one or two others, including the Hudson Essex. It seemed that there it was a question that they had to make profits, especially as improved machinery came out of their profits.

The question of making initial profits struck him as being more closely connected with the subject under discussion. The natural flow of work, stopping every two minutes each ten minutes, and so forth. Those are the sort of things that struck him as being the reason why the American motor car manufacturers made their initial profits, and from that they have been able to build up. They do not move forward, they do not appear to make enormous expenditure, except at definite periods, when they know they have made definite profits on the past year. Applying the same thought in many factories in this country, he did not see why we should not apply a system of rearranging the machinery which would not cost an enormous amount; he recollected one instance where exactly the same machines were used and rearranged. Probably the cost of rearranging them with the normal plant and men had not been more than proceeding with unnecessary operations and methods, and the savings were colossal. The particular case that had been tried out, along the lines that Mr. Gordon England suggested, was, to give an example which did not cost a lot, on a cylinder block, and the material saving alone in putting the machines in line, instead of having them in sections all over the works, was a demonstration that on a few machines could be made enormous saving. It seemed to him that from that case, of which he spoke from experience, if the same idea could be introduced into many British works to-day, by bodies of men such as produc-

tion engineers or planning engineers, that initial profits would be made, and then they could go forward and spend those profits on advanced machinery.

MR. GORDON ENGLAND, in reply to a comment of Mr. Hancock's, thought he (Mr. Hancock) had grasped the whole of the idea of what he was trying to convey. That is, that savings must be made by making use of elements. Save human elements and you will get profits. Mr. Hancock has given a case of direct saving by rearrangement of plant. He suggested that that rearrangement of plant was merely accessory. It was not that the plant did anything more, but it was used by the human elements to better advantage. He knew of another case where a similar experiment was tried. The same machines were used, but the plant was entirely altered in position, and it was accomplished by the saving of human effort. In other words, the people were not wasting their time, they were producers. They were paid on a certain rate, and in that time they did double the work at exactly half the labour cost. The result was that the particular works he had in mind converted the whole of the works to this system. There was a definite saving, and it was carried out in a very short time, and they had been prepared, if necessary, to make a temporary arrangement with their bank that they might have the necessary money at the moment, and it would be repaid at a very short call. If it is looked at from that point and the human element is studied all the time to see what can be done to eliminate unnecessary work, then, using an existing organisation, better results are obtained, and profits are made with which to make the changes. Then, to go a step further, he had mentioned better ventilation, but good ventilation systems are expensive. It is highly probable that you will have to put that on one side with the remark, "I cannot tackle that at the moment owing to certain circumstances, but I am going to do it. I will make savings on some things I can tackle in another direction and then I will get on and do it." The ventilation system then goes in, and out of the resultant further progress is made towards the bigger schemes. Conserve the human element as the first step. It made him wonder if we will ever get it right; he thought we would all see so much wrong with our own places that sometimes one almost despaired of getting on top of it. The whole thing is that we must save the human element. If profits are to be made in industry, we must find out how one can save the human element to assist in making still further savings, then improvements will automatically come out of profits.

A VISITOR remarked that Mr. Hancock had failed to mention one very interesting point concerning the rearrangement of the machinery. Not only had this action made a very definite saving in cost of production, but the operator's earnings had increased about 75 per cent.

MR. N. GERARD SMITH spoke on the question of apprenticeship. He thought Mr. Gordon England a brave man in his scheme for educating his younger labour. He had had experience of the work done by Messrs. Hans Renold in the same way; Metropolitan Vickers, of Manchester, also have a very good training scheme, but while there are only a few firms doing this, there are a number of less conscientious employers who simply wait to entice away these youths as soon as they are out of their time. Therefore, all the educational work that is done is to some extent lost to the firms who bear the brunt, and that state of affairs brought him to a suggestion that he wondered had never been made before. There are a number of firms who have an honest method of training their apprentices, but he thought it essential for apprentices to have experience in half a dozen shops. Why do these firms not get together and arrange an exchange of apprentices? They would at least keep them within the circle of those who have done the work in training them. Many firms to-day get a boy serving an apprenticeship, put him on a drill, and if he makes money there, there he stays. It is wrong for the trade and for the individual, and he suggested that Mr. Gordon England might, if he has not already done so, endeavour to arrange for this proposed exchange between firms. Referring to the question of education he had with him the syllabus of the Organisation and Management Courses at the Regent Street Polytechnic. Evening Classes are arranged for those in industry who have gone through some sort of technical training. He thought that a youth who has been through so many years in mechanical and electrical subjects ought to go on to works organisation and management, yet, as far as he knew, there are only two or three Polytechnics in this country supplying such evening classes, and the reason for this paucity is the shortage of lecturers. In the actual case of the Regent Street Polytechnic the shortage is so great that one man is giving 14 out of 25 lectures. These are some of the subjects on the syllabus: Principles of organisation, technical plant, factory layout, storage, material, mechanical handling, purchase, executive costs, principles of production, principles of jig and tool design, standardisation, market research, and so on. There is nobody, perhaps, certainly not anyone on the permanent staff of the Polytechnics, who can handle such subjects as well as the members of the Institution of Production Engineers, whose business is comprised of these items. As a matter of fact, in this particular course, there are two members of the Institution giving lectures, and he would like to see the principle extended to every college.

He would like to see specialists in any particular class taking one or two lectures under such a scheme so that their specialised knowledge is imparted to those about to enter industry or who are trying to improve their position.

Nobody had touched on the subject of labour turnover. He doubted whether anybody present knew—and this doubt extended to the majority of firms—the percentage of men they turn out of their factory as against the total employed. If anyone had had any experience in that line it would be interesting to hear it. In connection with welfare work he had been connected with one establishment where they formed a welfare committee. This became known later on as “the hell-fire committee,” and it was found to be an excellent opportunity to let off steam for those who wanted to talk. The price of beetroot was raised in the canteen, and it was wonderful the discussion they had about it! In one instance there was a question of the bad lighting of a pathway which led towards the works, so three workmen were deputed to meet the local governing bodies to discuss the question. After attempts, covering many months, to get in touch with these important people, they managed to meet them and, even then, came up against a blank wall. They then began to realise the difficulties which management has to face. The committee where men let off steam is quite an important one. Organisation charts showing the responsibilities of individuals and the scope of their activities within the works are known in many firms to-day, but it has not been taken far enough. In a particular instance within his experience it was really a laughing stock, for as soon as one made a success in one job one was transferred to another. This had allowed him to have seven jobs in seven years, but the unfortunate thing about it was that as soon as an organisation chart was published it was out of date. Nevertheless, it is an important thing, particularly to newcomers into an organisation.

Profits had been discussed, and arising out of that he would like Mr. Gordon England's remarks upon the liability of an organisation which lets a firm down. As production engineers we see many cases of firms who go under for no other reason but bad organisation, and it seemed to him that therein lies criminal liability. Not only are a certain number of creditors let down who get a lot of sympathy and 2s. 4d. in the £, but much more serious is the effect on labour. In some cases the staff, for no reason within their control, get a large share of the blame for the failure of the firm, particularly the production engineer. Who will engage the production engineer of a firm which has failed, although the failure may have been caused by the inefficiency of another department or even by the ineptitude of the Board?

Lastly, on the question of the capitalisation value of a man at £12,000. In buying a house one pays an amount approximately equal to 20 years' rent. £12,000, on that basis, would be £600 a year, and he would like Mr. Gordon England's opinion as to whether he thinks £3 to £3 3s. a week is conducive to getting the right type of man into the industry and to have his opinion of a fair reward for the services of a very highly skilled man.

Mr. GORDON ENGLAND, referring first to the Chairman's last remark, said he did not think the wages mentioned a proper reward for a man. He was very definite on this point, and said it was perfectly ridiculous to expect to get good results and good profits out of the earnings of these men. Viewed from the economic point of view, it is evident that these men are potential customers, and yet they do not receive enough money in wages to buy anything. He did not mind saying that he would not be satisfied until all his employees are able to afford motor cars. The first time he said that to his foremen they thought he was mad. His staff are all getting motor cars, but they have to make the money to do so. He considered that no man can be of any use to the country at the present usual rate of wages. It is a horrible wage really when it is analysed. He suggested the only way it can be raised is by conserving the human elements, because frankly their efforts are being squandered at the present time. No revolutionary movement will accomplish a revision of this state of affairs, but rather the application of everybody to the great problem of conserving every bit of human effort, and get the utmost work out of everybody. One can only get money through hard work, being very lucky if anything comes for nothing.

The Chairman had mentioned the question of the unprincipled firms who "pinch" your men. His view on this is that if we are efficient in ourselves and really watch our own good people and advance them they will not be "pinched" by outside firms, because we should be able to pay them much more than the outsider could ever hope to offer. We think the man across the road a low-down fellow for "pinching" our men, but it is because we have not satisfied that man's desire to get on that he is honestly glad to go somewhere else. It is possible to prevent "pinching" by watching everyone in our organisation, and giving them the chance to get on.

On the question of exchange of apprentices. It had never occurred to him, but he thought it could be done, and it may interest those present to know of a thing which has been started in this country, and he thought it might follow on much the same lines. He participated in what is called industrial group organisation. Little groups of industrial firms are being formed all over the country—all in entirely different lines of business. The whole essence of the thing is that all agree to throw the whole of the facts of their businesses open to one another. It had been agreed that there shall be no secrets amongst these various groups. That is all right in this particular instance, because each group is made up of non-competitive firms. He thought that the same principle could be applied quite well to apprentices, and it might be applied very well among production engineers. If the Institution pressed for this exchange of apprentices it could be carried forward, and it would help us all, and he would be very glad to consider such a scheme.

On the shortage of lecturers, he thought the Chairman's answer the best—that is, for production engineers to become lecturers: “they have so much time on their hands.” Seriously, it would be a good investment on the part of the production engineer.

He was glad the Chairman had mentioned labour turnover, for it seemed to be slipping everybody's attention. This country does not watch it closely enough, and it would be a very profitable investigation for the Institution to undertake.

Another point is the question of the responsibility of the workpeople. The Chairman had mentioned the “hell-fire” crowd at a certain works, and the question of getting the responsibility on to the workpeople themselves. He would like to mention a thing he was doing in an endeavour to get responsibility on to the workpeople, and make them understand the troubles of management. His firm is running its canteen on these lines, and the workpeople are entirely responsible for it. The firm will not finance it and will not give any assistance whatever, except to cover the apprentices. It had been an education to him, for the men are doing extraordinarily well. The food is good; he lunched in that canteen every day, and the same class of food that goes to the men in the shop goes to the management too. It is run by a committee drawn from the various shops, and the members are imbued with the idea that it is essential to make a profit. A sense of responsibility makes men easy to handle. He intended trying to extend that principle of putting the responsibility on the men, for it has worked very well in that case.

The Chairman touched a very difficult subject in the question of the criminal liability of those who let a firm down. It is a very serious liability, and it is one which every one of us has to be conscious of, but the question is—who is liable? Really it could be said with all fairness that the head of the firm, the board of management, the board of directors, should be the responsible people in every case. If there is going to be any criminal liability they should be the responsible people because they are there as trustees, but it seemed to him that they might turn round and say “That rotten production engineer let us down; he is responsible for it.” The answer should be “You should know he was a rotten production engineer.” It is impossible to come down the line, because after all the members of the board are in a position to choose the staff, and the responsibility should be theirs. Again, it would be a hard life for everybody under the board, for they would be afraid of criminal prosecution. This would entail a good deal of turnover in labour. It is a tremendous difficulty, and he honestly thought it almost a superhuman job to try to sort out this thing on the basis of making it a criminal offence or to punish it severely. Theoretically it can at law be done now, but it is very difficult to put the law into operation. He would like to stress this

particular point; he was at one with the meeting, and he had always told his workpeople that everybody in the firm has a responsibility, everyone in the firm is responsible for the maintenance and livelihood of everyone else in the firm. He always tried to put it in this way: If anybody, from the highest to the lowest, fails to do his duty he is letting down the whole firm. If a man in the shop knows anything is being done wrong and does not bring it to the attention of anyone above him he is letting down definitely all his fellow workmen. He is jeopardising their employment and jeopardising the security of the firm. It is applicable to everybody in the business, but the final responsibility must come back to the board of management. He was sure that that is a thing that can be very well stressed by production engineers when talking to their staff. He thought it an inevitable law in industry that every man is his brother's keeper.

MR. N. GERARD SMITH, in thanking Mr. Gordon England for his most excellent paper, said the members had been drawn out in a way which had not been equalled for a long while. He had got away from the jigs, tools, and automatics, and had given some views on life and its relation to industry which should provide food for much deep thought.

An Address on "The Registration of Engineers," given before the Institution by Mr. Hazelton, Secretary of the Society of Technical Engineers, January 26th, 1927, at the S.M.M.T. Offices, 83, Pall Mall, London, S.W.1.

I HAVE to thank your Council for inviting me, as representative of the Society of Technical Engineers, to open a debate upon the Registration of Engineers. In doing so I am going to do a rather unorthodox thing, for I am not going to debate the question of the desirability or otherwise of this action. I am going to beg that question, because I do not believe, in a gathering of this kind, that it is necessary for me to spend your time or mine upon discussing the general question as to whether or not it is desirable to have the registration of engineers. I will only say one or two words on that point.

The Society of Technical Engineers has been in existence from the end of the war, and is, as most of you know, a protective body to look after the economic interests of its members, all of whom are qualified engineers. In the years that have passed since its inception the members, particularly those who are responsible for the guidance of the Society—its Executive Council—have come to the conclusion that, if the main objects for which the Society was founded are to be achieved, there is nothing that can help in doing so more than a statutory measure for the Registration of Engineers. It implies, perhaps, that at the present time the organisation of the profession, so far as its guidance and direction are concerned, is not all that can be desired. We feel that there is a need, not merely for following the example of what has been done in so many other professions in the way of registration, but also in the way of bringing into being some responsible and thoroughly representative body which will be looked up to within the profession as a whole.

I propose to begin what I have to say by making a brief glance at what has been done already in this direction in a few of the other professions, and then giving a *résumé* of what has been done in the engineering profession in other countries.

Among the professions that stand out as being thoroughly organised are the Law, Medicine, Dentistry, and a few others. It is quite true that the Law is one of those professions which has not got what might be termed a written constitution, but we all know it is one of the most highly organised professions, a closed corporation, and that those who belong to it exercise, in effect, a

complete monopoly as far as the practice of their profession is concerned.

The medical profession, however, affords one of the most interesting illustrations of what has been done by means of statutory provision for safeguarding it. It is a long time since the first Medical Acts were placed on the Statute Book, and even the earliest of them was only passed after many years of organisation and agitation on the part of members of the medical profession. A year or so ago we had Dr. Cox, the Secretary of the British Medical Association, to outline the protective side of the work of the British Medical Association. He told us that the British Medical Association was twenty years in existence before it was as strong in numbers as the Society of Technical Engineers was at the time he addressed us, so it took them many years to win through to the position they are in to-day. I think there have been no less than between forty and fifty Medical Acts regulating, altering and changing the conditions and control of the medical profession passed since the middle of last century. The Medical Acts provide that no one can practice as a doctor who is not in possession of the qualifications laid down by the General Medical Council, and who is not on the register of that body. But these Acts do not give to the profession of medicine a monopoly in the same way as the Dental Acts give a monopoly to the dentists. One can set out to cure, claim to be able to cure, and charge fees for attempts to cure so long as no representation is made that one is a qualified medical man. Under the Dental Acts, one cannot charge for pulling out a tooth, even if being an unqualified person is disclosed. In other words, it is illegal to make a charge for extraction without being on the register of dentists.

One of the distinctions which that makes, as far as the General Medical Council and the Dental Board are concerned, is this: The doctors pay one registration fee of about £5 on becoming qualified, but the dentists have got to pay an annual fee to the Dental Board for their monopoly, and the result is that, while the General Medical Council is a comparatively poor body, because it receives only one fee from each man who becomes qualified, the Dental Board, which has only been a few years in existence, has already got an annual revenue of about £40,000, which it devotes to the promotion of the welfare of the profession. Curiously enough the dentists suffered in the first few years by having a measure of registration passed, because all advertising of dental services which used to be done by companies or unqualified persons was completely cut off and this restricted the practice of dentists throughout the country, but the work of advertising and propaganda is now being undertaken by the Dental Board. It is spending a considerable part of its revenue on that work. In spite of that temporary disadvantage, I think it can be said that

the whole of the profession is unanimously in favour of the measures that have been adopted, and would not think of going back to the old conditions of things. Of course, registration on the lines of the doctors or the dentists does imply a certain disadvantage from some points of view. A closed profession has its disadvantages, but, on the other hand, provided the safeguards are ample and sufficient, those who have had experience of what has been done in this direction are prepared to maintain that the advantages, not only to the profession but to the public at large, outweigh any disadvantages which there may be in the restrictions which must inevitably follow a measure of registration.

It is interesting to note that at the present moment there is a concerted move by another of the great professions to bring forward during the next Session of Parliament a measure for the Registration of Architects. This Bill has been prepared by a committee of the Royal Institute of British Architects. They are in the fortunate position of having brought under one roof, under one guidance and control, the various organisations connected with their profession, so that the Royal Institute is to-day practically the only body of any importance speaking for the architects in this country. Therefore they are in a much simpler position for dealing with the question of registration than are engineers, who have so many different bodies, each with varying outlooks, regulating their own particular section of the engineering profession. In dealing with the question of registration for engineers, it is our opinion that it will be most helpful to have this Bill for the Registration of Architects promoted in the coming Session, because the two Measures may help each other; if one makes progress, that progress will be shared by the other, therefore we look forward with interest and with great satisfaction to the fact that the Royal Institute of British Architects is proceeding, as soon as Parliament meets, with the introduction of its measure.

Before coming to the Engineers' Bill I would like to say a few words about the position regarding the registration of engineers in other countries. Registration has, for several years, been the law of the land in many of the States of the American Union. The general plan is much the same in the various States, but let us take the law in the State of New York as a characteristic example. That provides a very rigid and strict monopoly for the practice of engineering in that State. No one is allowed to practise, or claim to practise, engineering unless he is registered under the Statute in New York. It does make exceptions for certain particular types of work, and men engaged upon certain works are not required to register, but in general no one is allowed to practise engineering in the State of New York unless his name is upon the register.

It is only within the last two years that a somewhat similar

measure has been adopted in Italy. Registration is now a law for both architects and engineers, and in order to practise either of those professions it is necessary for one's name to be upon the register. Conditions there are rather exceptional in some ways; the new scheme only came into operation in Italy at the beginning of last year. It is worked through Provincial and Regional Councils, with the Head Council at Rome, and it promises to be a very interesting experiment for those who are interested in this question.

The latest country to adopt registration, the only one we know of within the Empire, is the Dominion of New Zealand. Their registration came into operation about the middle of last year, and it is rather early yet to expect reports giving detailed particulars about the way in which the Act is working. In New Zealand they have followed a rather simple plan, but it is one which I do not think would be at all possible in this country. That is, they have set up a small Board for the work of registration, which Board will determine the qualifications for those whose names are to be entered upon the register, but the scheme is really being worked through one of the Government Departments of New Zealand.

Australia has not yet attempted registration, but the leading institution of engineers in Australia has been in communication with us when they heard about the project for the introduction of our Bill. They told us that they are preparing a measure for submission to the Commonwealth Parliament of Australia, and that we will soon be in a position to examine their proposals.

That is just a brief outline of what has been done elsewhere. If we come to our own country, I can say that, as far as we have been able to ascertain, opinion on the general principle of registration in the engineering profession is practically unanimously in favour of it. Here and there you will come across strong individualists who say they think that the profession ought to remain unfettered and without the controls which would be indispensable in any scheme of registration, but the great majority of the profession is in favour of registration, and I think I can say that without any reserve. In fact, it is proved by the previous history of the question of registration. Only five or six years ago one of the leading institutions in this country, the Institution of Civil Engineers, prepared and drafted a Bill for Registration. It did so in response to the demand of its own members, and the principle of the Bill had the support of the other leading Institutions. That Bill was not proceeded with, because its details were objected to very strongly by the other Institutions, the Mechanicals, the Electricals, and so on. The grounds of their objections were, somewhat reasonably, that the particular clauses of this Bill, which had been drafted by the Institution of Civil Engineers,

gave that Institution an almost exclusive right to the control of the proposed register, and left the others practically entirely on one side. Frankly, they were not prepared to submit to that, and the result was somewhat unfortunately to delay, for the interval between then and now, the further consideration of the question of registration by those who would have been in the best position to carry it out. It cannot be too clearly emphasised that, while that unfortunate failure is there to face us, it was a failure not due to any objection to the principle of registration, but was entirely due to the particular proposals which had been put forward.

I would like to say here, Mr. Chairman and Gentlemen, that it really is with a view to pledging the whole question of registration and making it once more, as far as we can, a practical thing, that the Society of Technical Engineers has prepared and put forward the proposals contained in the present Bill. The Society felt it would be helpful to lay before the profession its suggestions, in the form of a preliminary measure, as the basis for the discussion of the whole subject. It does not take upon itself, in any way, the task of settling the plan of registration. That is for the considered judgment of representative opinion within the profession as a whole. There are many interests to be consulted; the number and variety of the organisations within the engineering profession make it specially difficult to focus opinion upon a question of this kind, but it was with a view to bringing about such concerted action as can be procured at this stage that the Society of Technical Engineers has prepared this plan and tabled it so that all who are interested in the question can consider the suggestions we are putting forward. I need not say that, in drafting it, our committee had before it the full details, not only of what had been proposed by the Institution of Civil Engineers in their Bill, not only all the Statutes that have been passed in this country for the other professions, but also the Bills for the registration of engineers that have become law in other countries.

The leading Institutions in this country are the proper bodies to have the final word, subject to the approval of Parliament, in a matter of this kind; if they had taken action before it would not have been necessary for a comparatively unknown and small body like the Society of Technical Engineers to take the initiative. In our opinion, the best plan would be to take steps to appoint a committee, thoroughly representative of the profession, on registration. That was what the Royal Institute of British Architects did in its own case, and it should not be difficult, nor impossible, for the engineering profession to take similar measures through the Joint Engineering Council, or by some similar means. Our Society has informed the Joint Engineering Council (you are

probably familiar with that Council, it is representative of some of the leading Institutions in the profession) that, if it will take up the question with a view to the preparation and presentation of a Bill, we will be pleased not to proceed with our own measure, the important thing being, in our view, to see that the question is not laid upon one side and neglected as it has been, but to see that it is taken up with a view to getting registration legalised. The Joint Engineering Council is to meet before the end of this month, and I hope we shall hear what its attitude is to be, but it is our intention, unless it can see its way to take up the matter, to proceed with this measure, which we introduced into Parliament last Session, and reintroduce it during the coming Session, subject to whatever modifications and suggestions other Engineering authorities and Institutions may make desirable.

It is, of course, a Private Member's Bill, as the Bill for the Registration of Architects will also be. That means that there is not a very great chance of getting either of these Measures fully considered by Parliament unless they happen to win a place in the Private Member's Bill ballot at the beginning of the Session.

In the first few weeks of the Session all the Members of the House of Commons are entitled to ballot for places for Private Member's Bills, and generally the first dozen or so who win places can introduce whatever Bills they are interested in. Friday afternoon in each week in the early part of the Session is given for the consideration of these measures, and it generally means that about the first dozen men who win in the Ballot have a good chance of getting the Bill they are interested in passed into law. Naturally, there is considerable pressure upon the members who are taking part in the ballot to favour a particular Bill. Quite a number of Members in the House have promised to ballot for the Engineers' Bill, and if we are lucky enough to win a place for this Bill in the early part of the coming Session, there is a good chance of making excellent progress towards the Statute Book.

The foregoing gives an idea of how this proposal for the Registration of Engineers has come to be in the hands of our Society at this stage, and of what we have already done, and I would now like to give a brief outline of some of the principal clauses in the Bill which has been introduced into Parliament.

Our Committee felt, after examining the various measures that are in operation elsewhere and for other professions, that, in view of the conditions prevailing in the engineering profession, the best model that we could take would be the medical profession, and on that model constitute a General Engineering Council, somewhat analogous to the General Medical Council set up under the Medical Acts. There are on that body not only medical men, but also non-medical men appointed by the Government to represent the public interest. We felt that example might be followed, and

the constitution of a General Engineering Council might be somewhat as follows: First of all have the public interest represented through appointments made by the Government. Then have the engineering sections of the Public Services represented, the engineers of the Army, Navy, Air Force, and Civil Departments. Next, the scientific institutions, which would correspond to the Institutions in the case of the Medical Act. Then the Universities on the educational side, because each University in the United Kingdom is represented on the General Medical Council. We also felt there ought to be representatives of the important Colleges, and, in addition, in view of the very close association between the interests of engineering and the interests of industry in general, it was felt that it would be desirable to have some representation of engineering employers' organisations, and one or two places on the Council for engineering employees' organisations as well.

These, I need hardly say, are purely suggestions which are subject to amendment and reconsideration as may be found to be desirable. If there was a single body representing engineering, as there is practically for the architects, it might be possible to put the guidance of the profession and the sole charge of registration in the hands of its Council. Under the Architects' Registration Bill there is to be no such plan as we have outlined. The Council of the Royal Institute of British Architects is to be the dominant body in control of the training for the profession and in charge of registration. We felt it was not possible, in view of the organisation of the engineering profession with so many interests and so many bodies, to follow their plan, and that is the reason why the principal clause in our Bill makes suggestions for the very much wider representation than is followed in the case of the architects.

Now, as I said earlier, when the Bill of five or six years ago was drafted, it followed practically the plan of the Architects, but that was on the assumption that there was only one engineering body—the Institution of Civil Engineers—and that was the reason for the failure I have already mentioned. Our Bill may go to the other extreme by taking in too many interests, but it avoids the danger which wrecked the earlier Bill. Probably the best thing would be a compromise between the two extreme plans, but we believe in making the Council as representative as possible. Whatever difference of opinion there may be on the very important question of the constitution of the General Engineering Council, there is likely to be no difference of opinion with regard to the powers and duties of whatever body is set up to take charge of these measures, because in this respect the lines followed by the Medical Council, by the Dental Board, by all the Engineering Acts abroad, and by the whole of the professions, is practically the same. The powers and the duties are really set by a Government Department for the control, conduct, and etiquette of the

profession, and naturally the welfare and the future of the profession must very largely be in the safe keeping and in the hands of such a body. It will be for a body of that kind to determine the standard of training and qualifications required, to keep the register of members, and to keep the status and welfare of the profession worthily maintained.

The other most important provision in the Bill which the Society of Technical Engineers has drafted is the provision which would decentralise the work of registration. It would be possible if a General Engineering Council was called into being for everybody who was qualified and wanted to register to do so through that body. In effect, that is what would happen, but what we propose in practice is this: that the Institutions which are represented on the General Engineering Council will be the registering bodies, and that everyone who desires to and is qualified to register as an engineer, will do so through his own Institution. In other words, the Institutions are given an organic position in connection with this scheme of registration. If that were not so, it would be possible for a great mass of men to register direct with the Council, and not belong to any of the Institutions, and the result might be in time to undermine the influence, the strength, and the standing of even the big Institutions, if these were not brought into organic relationship with the scheme of registration. In making use of the existing machinery of the profession, it implies that everybody must belong to one or other of the Institutions, so we have provided for a statutory fee which will be uniform for all grades of registered membership no matter what Institution a man joins. We have suggested that if it is to be £4, £1 of that fee would go to the General Engineering Council, and the balance of £3 would be for the registered membership of the Institution with which the engineer was registered. In that way the engineering profession would have a General Council with a revenue analogous to the £40,000 of the Dental Board, and it is proposed that that money should be available for the furtherance of the general interests of the profession.

Clause 22 says "The General Council shall have power to utilise such parts of the monies at its disposal as it may deem fit for the promotion of engineering education and research, and for the establishment of superannuation schemes and benevolent schemes for registered engineers. It shall also have power to pay to the members of the General Council such fees for attendance and such reasonable travelling expenses as shall from time to time be allowed by the General Council."

Those are the two most important clauses in the Bill, because they are the clauses which really shape the character of the scheme as it exists in the present draft. The other clauses are mostly matters of detail, with one or two exceptions.

It is proposed, for instance, under Clause 6, to limit the title of Engineer to those who are registered under the Bill.

A year or two ago, when our London Committee was doing some work for the Board of Trade in connection with the preparation of the census of production, the Board of Trade agreed to include for us the enumeration of the number of engineers engaged in the industry in this country, but when it came to putting it down in black and white, they said "Will you please tell us how to define an engineer," it was found that nobody could provide the Board of Trade with a satisfactory definition of the term "Engineer," and so the proposal which they had agreed to could not be carried out in practice. Clause 6 says the title of Engineer shall belong exclusively to those persons who are registered under this Act, so that difficulty, if this measure becomes law, will be swept away. The architects have a similar clause in their Bill, and nobody, if their Bill becomes law, will be empowered to call themselves an architect or to use the term architectural in a description of their calling.

One provision which will be of particular interest is in Clause 18, which provides for the use of seals by registered engineers. That clause was taken from the Act of the State of New York, which provides for the issue of seals to all engineers who are registered in that State. We propose to strengthen the provision of the New York regulation, and I would like to read to you the section which covers that point. "The General Council shall cause to be prepared seals of a design approved by it. On the application of a registered engineer for a seal the General Council shall cause an identification number or other mark, corresponding to the identification number or mark of the engineer on the register, to be stamped or engraved on the seal before furnishing it to the applicant. All plans, drawings, designs, tenders, estimates, certificates and other like documents directly of an engineering order originating later than two years after the commencement of this Act and used by a registered engineer or by an engineering firm in connection with any work, or issued by a registered engineer or by an engineering firm to any client, whether contractor, architect, manufacturer, trading company or other customer, shall be stamped with the seal or seals of the registered engineer or engineers immediately responsible for their production," and it goes on to make penalties in the event of a breach of this regulation. The underlying motive for the adoption of that provision was this, that in our experience, at the present time, there is a good deal of work that is not but ought to be done by technically trained men, also we feel that only technically trained men should hold technical positions, and this is an effort to secure the more effective carrying out of those principles. It brings home the responsibility of the technically

trained man, and this Act makes his position and his duties more responsible, and it will ensure if adopted, that only technically trained men will hold technical positions.

I need not spend any time over the other clauses, because they are purely clauses of machinery. I hope enough has been said to give you an idea of the general plan. I would only like to add that there is a clause safeguarding the rights of engineers practising their profession at the time of the commencement of this Act, whatever their academic qualifications may be. It is made amply secure that no man will be prejudiced in any way.

Clause 8 says " Every person who at the date of the commencement of this Act was a member or associate member of any of the Institutions represented on the General Council, or who at that date was a member or associate member of any other Institution or professional association or society directly concerned with engineering, shall, provided application be made to a Statutory Council within two years after the commencement of this Act, be entitled to a certificate of registration without question as to other qualifications; and every other person, not being a member or associate member of such Institution, association or society at the date of the commencement of this Act, but who within two years of its commencement produces to a Statutory Council satisfactory evidence, supported by a sworn declaration, that such person has been engaged in engineering work in a responsible capacity for not less than five years, shall, subject to the application being endorsed in writing by at least three registered engineers, be entitled to registration under this Act."

Therefore, any man who is actively engaged in the profession of engineering need not fear that he will be prejudiced by a measure of this kind. It will not be making engineering a monopoly in the same sense that dentistry is a monopoly. It will be the beginning of a closed profession of engineers, because nobody will be recognised as an engineer or entitled to use the name who is not brought under the scheme, and the profession will in future years, as the doctors and dentists have found in their case, and as the architects believe in theirs, be improved in public service and status by a comprehensive scheme of this kind.

**A BILL PROMOTED BY THE S.T.E.
TO PROVIDE FOR THE REGISTRATION OF AND TO REGULATE
THE QUALIFICATIONS OF ENGINEERS.**

Be it enacted by the King's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

1. The General Council of Engineering.—For the purposes of this Act there shall be established a Council which shall be styled " The General

Council of Engineering" (hereinafter referred to as the General Council), which shall be a body corporate, with perpetual succession and a common seal, and with power to acquire and hold land.

2. Constitution of the General Council.

(1) The General Council shall be constituted as follows:—

- (a) Four persons, not being engineers, appointed by the Privy Council, one each resident in England, Scotland, Wales, and Northern Ireland, respectively.
 - (b) Four persons, who shall be engineers attached to the following services: the Royal Navy, the Royal Engineers, the Royal Air Force, and the Mercantile Marine, one each appointed respectively by the First Lord of the Admiralty, the Secretary of State for War, the Minister for Air, and the President of the Board of Trade.
 - (c) Sixteen persons, who shall be engineers, elected as follows: four by the Statutory Councils of each of the following institutions: The Institution of Civil Engineers, the Institution of Mechanical Engineers, the Institution of Naval Architects, and the Institution of Electrical Engineers.
 - (d) Not more than six persons, who shall be engineers, elected by the Statutory Council or Councils of such other Institution or Institutions, if any, as the General Council may determine ought to be represented.
 - (e) Six persons, who shall be engineers, elected by the Council of the Association of Technical Institutes.
 - (f) Six persons, who may or may not be engineers, elected by the Deans of the Faculties of Engineering of the Universities of Great Britain and Northern Ireland; provided that in the case of a University which has no Faculty of Engineering, the General Council shall determine how such University is to be represented in the election.
 - (g) Not more than four persons, who may or may not be engineers, elected as follows: two by the Board of the Engineering and Allied Employers' National Federation, one by the Committee of the Association of Consulting Engineers, and one by the Executive Council of such other organisation of engineering employers, if any, as the General Council may determine ought to be represented.
 - (h) Not more than four persons, who shall be engineers, elected as follows: one by the Council of the Society of Technical Engineers, one by the Council of the Electrical Power Engineers' Association, and one each by the Executive Council or Councils of such other organisation or organisations of engineering employees, if any, as the General Council may determine ought to be represented.
- (2) The members of the General Council shall hold office for such term not exceeding five years as may be determined by the body or persons by whom they were appointed or elected, and shall be eligible for re-appointment or re-election on the expiration of their term of office.
 - (3) As soon as may be after its constitution, the General Council shall take all steps necessary to complete its membership, as provided for in subsection (1) of this section, and the additional members shall be added to the General Council as from the date of their election.
 - (4) The General Council shall hold its first meeting within three months from the commencement of this Act in such place and at such time as one of His Majesty's Principal Secretaries of State shall appoint.

3. Duties of the General Council as to Qualification for Registration, etc.

- (1) It shall be the duty of the General Council to fix the qualifications entitling persons to registration under this Act; to keep a register of such persons, and to publish annually lists of the names and addresses of registered engineers, together with such information regarding their qualifications as it may determine; to take such steps as may be necessary to prevent unregistered persons from using titles or descriptions calculated to give the impression that they are registered under this Act; to cancel or suspend the registration of any such person whose name in its opinion, after due enquiry, ought to be removed from the register temporarily or permanently owing to conviction of any heinous offence or to unprofessional conduct of a serious nature; and generally to do what may be necessary to give effect to carrying out the purposes of this Act.
- (2) In fixing the qualifications for registration under this Act the General Council, in addition to determining the standard of examinations required for registration, shall also determine as far as possible what practical qualifications shall be required, such as:
 - (a) An engineering apprenticeship, or
 - (b) At least three years practical experience of some form of engineering work, or
 - (c) Two years at least in a responsible position such as presupposes the possession of a practical knowledge of engineering, or
 - (d) The service of articles to a registered member of an Institution represented on the General Council, or
 - (e) Such other practical experience as the General Council may determine.

4. Registered Membership of the Institutions.—Every person entitled to registration who desires to be registered under this Act shall apply to the Secretary of the Statutory Council of one of the Institutions represented on the General Council for a certificate of registration, and shall forward with such application a statutory fee of four guineas. On receiving a certificate of registration, every such person shall become a registered member of the Institution, and shall be entitled to retain such membership (unless removed from the register for any cause by the General Council) on payment of an annual statutory fee of four guineas; provided that no person shall be required to pay a statutory fee to more than one Institution, and that any person entered on the register of one Institution may be elected to any grade of membership of another Institution, at the discretion of its Council, and may, if the Council so decide, be entered on the list of its registered members. The rights and privileges of registered members of an Institution shall be such as the Council of the Institution may determine, provided that registered members of an Institution shall have the right to elect the Statutory Council of the Institution, as provided in section five.

5. Powers and Duties of the Statutory Councils of the Institutions.

- (1) Every Institution represented on the General Council shall during the third year after becoming so represented, elect (under rules approved by the General Council) a Statutory Council which may or may not, at the discretion of the Institution, be its Council for the general conduct of its affairs apart from its powers and duties under this Act; and until such Statutory Council has been elected, the Council for the time being in office shall be the Statutory Council for the purposes of this Act. The Statutory Council of an Institution shall be the body responsible for the

carrying out of the powers and duties of the Institution under this Act. It shall be elected by the registered members of the Institution from among their own number on an equal franchise, and shall consider and decide on all applications for registration, but shall not have power to refuse registered membership to any applicant except on the ground that the qualifications of such applicant do not comply with the conditions laid down by the General Council or with the provisions of this Act, or that the character of the applicant is such as to justify a refusal of the application.

- (2) The Statutory Council of an Institution shall transmit to the General Council particulars of all members registered by it, together with 25 per cent. of all statutory fees received by it, and shall keep the General Council informed of alterations that take place from time to time in the addresses or qualifications, etc., of its registered members. It shall also transmit particulars of all cases in which it had refused registration, stating the grounds of its refusal.
- (3) It shall be the duty of the Statutory Council of an Institution, after due enquiry, to recommend to the General Council that any of the registered members of the Institution convicted of a heinous offence or judged by it to be guilty of unprofessional conduct of a serious nature should have their names removed from the register, or should be suspended for a stated period; provided that any person who feels aggrieved by the refusal of a Statutory Council to grant a certificate of registration or by a recommendation that registration should be cancelled or suspended, or by any other decision, shall have a right of appeal to the General Council within two months of being notified of the decision complained of. Where, on appeal, the General Council amends, alters or reverses a decision of a Statutory Council, its decision shall be binding on the Statutory Council concerned.

6. Title of Engineer.—The title of Engineer shall belong exclusively to those persons who are registered under this Act.

7. Unlawful Acts and Penalties.—Any person who, in making application for registration under this Act, knowingly gives false information as to qualifications, training, experience or other material particulars; any person who, not being registered under this Act, makes representations to the contrary; and any unregistered person who, later than two years after the commencement of this Act, uses the title of Engineer, with or without any other qualifying words or descriptions, such as "Technical Engineer," "Civil Engineer," or otherwise, shall be guilty of a misdemeanour, and shall, on summary conviction, be liable to a fine not exceeding £50 for each offence or to a term of imprisonment not exceeding three months.

8. Rights of Engineers Practising their Profession at the time of the commencement of this Act.

- (1) Every person who at the date of the commencement of this Act was a member or associate member of any of the Institutions represented on the General Council, or who at that date was a member or associate member of any other Institution or professional association or society directly concerned with engineering, shall, provided application be made to a Statutory Council within two years after the commencement of this Act, be entitled to a certificate of registration without question as to other qualifications; and every other person, not being a member or associate member of such Institution, association or society at the date of the commencement of this Act, but who within two years of its commencement produces to a Statutory Council satisfactory

evidence, supported by a sworn declaration, that such person has been engaged in engineering work in a responsible capacity for not less than five years, shall, subject to the application being endorsed in writing by at least three registered engineers, be entitled, on application, to registration under this Act.

- (2) In case of a question arising as to whether any Institution, professional association or society is to be regarded as an Institution, professional association or society covered by subsection (1) of this section, such question shall be determined by the General Council; and in case any Statutory Council considers that an application for registration made to it ought properly to be made to the Statutory Council of some other Institution, and so notifies the applicant, giving the name of the Institution, such applicant may, if he dissent from such decision, refer the question to the General Council, whose decision shall be final.

9. Engineer Officers in Crown Forces and Mercantile Marine to Register.—Later than two years after the commencement of this Act, no person shall hold any appointment as an engineer in the Naval, Military or Air Services, or in the Mercantile Marine, unless such person be registered under this Act; provided that nothing in this Act shall be held to repeal or alter any statutory provisions in force dealing with the above Services at the time of the commencement of this Act.

10. Power to Set up Sections within the Institutions.—If after the receipt of a written requisition signed by not less than two hundred registered members of an Institution asking for the establishment of a Section within the Institution concerned with a particular branch of engineering, the Statutory Council of the Institution, on investigation, determines to establish such a Section, it may, subject to the approval of the General Council, make such arrangements for that purpose as seem to it to be desirable, including arrangements for the holding of special examinations in the particular branch of engineering concerned.

11. Power of General Council to Regulate its own Procedure, etc.—The General Council shall meet at least twice every year. It shall have power to draw up rules, regulations and standing orders for the conduct of its proceedings, and may delegate any of its powers to Committees appointed from among its own members. It shall appoint its own officers and staff, including a registrar, at such rates of pay as it may consider proper, and may also appoint from among its own members regional Committees in such parts of Great Britain and Northern Ireland as it may deem to be necessary; provided that decisions of any of its Committees that affect the regulation or qualifications of the engineering profession as a whole shall be subject to confirmation at a meeting of the General Council.

12. Registrars to Notify Deaths.—Every registrar of deaths in Great Britain and Northern Ireland on receiving notice of the death of a registered engineer shall forthwith transmit by post to the registrar of the General Council a certificate under his own hand of such death, and may charge the cost of such certificate and transmission as an expense of his office, and on the receipt of such certificate the registrar of the General Council shall erase the name of such deceased registered member from the register, and shall notify the fact to the Secretary of the Statutory Council or Councils of such Institution or Institutions to which the deceased member belonged.

13. Right of Appeal to High Court.—In any case where the General Council, on appeal from a Statutory Council, refuses to grant a certificate of registration, or decides to suspend or cancel the certificate of a registered engineer, there shall be a right of appeal to the High Court.

14. Engineers Qualified in the Dominions and Abroad.—It shall be lawful for the General Council by special orders to dispense with such provisions of this Act or with such part of any regulations made by its authority as

it may consider fit in favour of persons practising engineering within Great Britain and Northern Ireland on diplomas or degrees acquired outside Great Britain and Northern Ireland.

15. Only Registered Engineers Entitled to Recover Charges or Issue Certificates.—After the expiration of two years from the commencement of this Act no person shall be entitled to recover any charge in any Court of Law for any services rendered as an engineer unless such person is registered under this Act, and no certificate required to be given by an engineer shall be valid unless the person giving the same is registered under this Act.

16. Powers of General Council to Approve Courses of Study and Examinations.—In case it appears to the General Council that any courses of study or any examinations to be gone through in order to qualify for registration under this Act are not such as tend to secure the possession of the requisite knowledge and skill for the efficient practice of their profession by the persons who undergo them, it shall be lawful for the General Council to issue to the responsible authority due notice that unless within six months the conditions are amended to the satisfaction of the General Council, such courses of study or such examinations shall not be recognised as contributing towards the qualifications entitling a person to registration under this Act.

17. Application of Penalties.—Any sum or sums of money arising from conviction and recovery of penalties under this Act shall be paid to the treasurer of the General Council.

18. Seals of Registered Engineers to be on all Plans, Tenders, etc.—The General Council shall cause to be prepared seals of a design approved by it. On the application of a registered engineer for a seal the General Council shall cause an identification number or other mark, corresponding to the identification number or mark of the engineer on the register, to be stamped or engraved on the seal before furnishing it to the applicant. The charge for a seal shall not exceed twenty shillings. All plans, drawings, designs, tenders, estimates, certificates and other like documents directly of an engineering order originating later than two years after the commencement of this Act and used by a registered engineer or by an engineering firm in connection with any work, or issued by a registered engineer or by an engineering firm to any client, whether contractor, architect, manufacturer, trading company or other customer, shall be stamped with the seal or seals of the registered engineer or engineers immediately responsible for their production. The use or issue of all such documents originating later than two years after the commencement of this Act without a seal or seals shall be *prima facie* evidence that they were not prepared by or under the immediate supervision of a registered engineer or engineers, and the persons, firm or company using or issuing them in connection with the execution of any engineering work shall not be entitled to recover in any Court of Law any charge for such work. Provided that where copies of such documents, not being originals, are used or issued in connection with any engineering work, such copies, if without the seal or seals of the engineer or engineers immediately responsible for the preparation of the original, shall bear in writing or otherwise the registered number or mark of such engineer or engineers together with the seal of the engineer or engineers immediately responsible for the preparation, use or issue of the copies.

19. Penalties for Wrong Use of Seals.—Any registered engineer who affixes his seal or causes it to be affixed to any plan, drawing, design, tender, estimate, certificate or other document directly of an engineering order for which such engineer was not immediately responsible, or which was not prepared under the immediate supervision of such engineer, and any registered engineer who uses the seal of another registered engineer, shall be deemed to be guilty of unprofessional conduct such as to warrant

suspension or removal from the register; and any person, not being a registered engineer, who wrongfully uses the seal of a registered engineer shall be deemed to be guilty of a misdemeanour, and shall, on summary conviction, be liable to a fine not exceeding ten pounds or imprisonment for not more than fourteen days.

20. Engineering Documents produced Abroad Exempt from Seals.—All documents directly of an engineering order produced by or on behalf of persons or firms in foreign countries or the Dominions for issue or use in Great Britain or Northern Ireland (if not produced by or under the immediate supervision of an engineer or engineers registered under this Act) shall be exempt from the provisions of sections eighteen and nineteen of this Act; provided that the persons, firm or company producing, issuing or using them in connection with the execution of any engineering work in Great Britain or Northern Ireland shall not be entitled to recover in any Court of Law any charge for such work, unless all such documents bear the name and address of the persons or firms abroad by whom or on whose behalf they were produced, issued or used, together with the words: "Exempt from Seals because of production abroad."

21. Unlawful to Describe any Business as that of Engineer or Engineering unless a Registered Engineer engaged therein.—Later than two years after the commencement of this Act it shall not be lawful for any person or for any firm or company, whether registered under the Companies Acts or not, to describe their business as that of an engineer or engineers (with or without any qualifying term such as "electrical engineer" or otherwise), or to describe their firm or company as an engineering firm or company, unless there is at least one registered engineer actively engaged in the carrying on of the business of such persons, firms or companies; any person or persons so doing shall, on summary conviction, be liable to a fine not exceeding £50 for each offence.

22. Power of General Council to aid Education, Research, Superannuation, etc.—The General Council shall have power to utilise such parts of the monies at its disposal as it may deem fit for the promotion of engineering education and research, and for the establishment of superannuation schemes and benevolent schemes for registered engineers. It shall also have power to pay to the members of the General Council such fees for attendance and such reasonable travelling expenses as shall from time to time be allowed by the General Council.

23. Short Title and Commencement.—This Act may for all purposes be cited as "The Engineers Act," and shall commence and take effect on the 1st day of January next after its passing.

EDITORIAL.

(January, 1928.)

IT is good to place on record that, since writing our previous Editorial, real progress has been made towards Peace in Industry.

Of greatest promise is the Conference about to take place between the General Council of the T.U.C. and representative employers. That their deliberations will be exhaustive is evident by the fact that results are not expected before the Autumn.

We ask all those who enter the Conference to do so fully determined, first of all, to discover their points of agreement; the differences will then be found to relate to the method of implementing their desires and not to any fundamental principle.

All of us—master, man, or “poor-devil-in-between”—desire the fullest return for our labour; only when we come to a full understanding of our utter interdependence shall we enter the realm of satisfied desire. “Honesty is the best policy” is not only a moral precept, but an economic truth.

Lack of space prohibits more than a bare record of the fact that several firms have already taken active steps to co-operate with their employees, some promising experiments having been initiated by the L.M.S. Railway, Sir Alfred Mond, and Messrs. R. A. Lister, of Dursley. Their experience should be of great assistance to the Conference, especially if it is examined in conjunction with results already attained by such firms as Lever's and Cadbury.

We cannot conclude better than by quoting a leader from the columns of the *Daily Chronicle*:

“For both (labour and capital) stand or fall by production. Neither can hope to gain except by higher or more efficient production; both must lose by lower or less efficient production. In proportion as they stand in opposition to each other . . . both are handicapping industry, making it . . . less able to employ labour and pay high wages.”

The Production Engineer begins to receive recognition!

Discussion on Mr. C. R. F. Engelbach's Address. Birmingham Branch.

(September 28th, 1927.)

MR. HANNAY, President of the Birmingham Branch, in declaring the meeting open for discussion, said that he hoped visitors would consider themselves as members for the evening and contribute their comments on such an interesting and thought-provoking address.

SIR HENRY FOWLER, after congratulating the President on his election and on the excellent meeting, said he proposed to confine his remarks to deal only with the question of education and not on the paper generally.

The author had raised a very interesting point, and that was, if a young man who finally became a Production Engineer could be selected so early as to be trained for this particular work, it would seem that such a course would tend to limit any promotion beyond this. He agreed with the author that it was necessary for those occupying the highest positions in a factory to have a somewhat universal knowledge, and he felt that in the early stages of a young engineer's education his training should be on general lines, if he was at college, specialising in a third or fourth year.

He had always felt that, in the training of engineers, it was better if a young man had a short time in the shops, then proceeded to a university, afterwards coming back to complete his technical training.

In America he had always found that a very large proportion of their supervisors were college-trained, but not in any particular or definite line.

MR. FRED ARCHDALE said :—We have just listened to a most interesting address and, as a machine tool maker, I suppose it is quite in order for me to make some observations on the machine tool section of the paper.

I would like to remind you of a very old saying, "A country has the government that it deserves," or words to that effect. I would say without fear of contradiction that an industry has the machine tool service that it deserves.

Any section of industry that equips itself with obsolete and second-hand plant from this or other countries, in my opinion, is not giving British machine tool makers a fair chance. In fact, I would go so far as to say that it is taking unfair advantage of its position as a protected industry.

In any case, it is rather interesting to hear the motor trade—a protected trade—telling us, an unprotected trade, that we have

not done as well as the American and European machine tool trades, both heavily protected.

I am sure Mr. Engelbach does not realise the difficulties under which we laboured while this country was absorbing the war stocks of this country and America, at the same time helping to pay for the war.

I can remember a time when it was practically impossible to sell new machine tools after the buyer had looked at the price, whatever their productive capacity.

However, we hope that the visits Mr. Engelbach and others have made to a more enlightened machine tool buying country will enable us to regard that period as a bad dream.

It is interesting to hear what Mr. Engelbach says with regard to American production guarantees, and I would be glad to know if he obtains equal results on English material.

I hear with some pleasure that the machine tool makers in America receive much greater encouragement from their manufacturers.

It should not be lost sight of that the machine tools and methods that can be economically employed in a high-wage country like U.S.A. cannot in all cases be economically employed here, and this is one of the greatest disadvantages under which we labour. Interest on capital, depreciation, etc., loom very much larger when compared against a low wage rate.

Mr. Engelbach claims that certain types of machines are not made in this country, but I can assure him that some of them are made and bought by motor firms in this country and abroad who might have gone to U.S.A. for them, but as this is not an advertising convention, I will not give chapter and verse.

Regarding German copies of high-production American plant, I would again repeat that they have quite a comfortable tariff wall behind which to do it.

Another difficulty from our point of view is the size of the market. If we produce a machine selling for, say, £500, we probably have a development charge of £500, if we are lucky, and more if we are not.

The market for high-production machines is so small that in many cases we know that however good a machine is we cannot sell enough to get back the development charge; this is assuming we get the whole market, but we do not get anything like that owing to the man who will not buy until he is quite satisfied that the machine tool maker is working at a loss.

When some buyers have driven the machine tool maker into a corner and played one off against another until there is no profit for anyone, he thinks that he has done a good day's work.

Well, Gentlemen, there is one thing that is certain, and that is that unless you allow us to make profit on special purpose machines,

the time will come when you will have to buy them all in America and you will have to pay a price then which will give the American machine tool maker some profit.

There is also the question of delivery, and in most cases we are not given enough time, as the demand does not arise in this country until the machines are in production in America.

I would state that in a general way the machine tool maker in England has not had a fair chance, largely owing to the huge and educated American market and the parsimonious buying in this country.

To this there are some striking exceptions and those firms, to my knowledge, have had no cause to regret it. In certain cases also it is difficult for the machine tool maker in this country to get the opportunity of even discussing new types of machine tools with the engineering department. He is "held up" by the buyer.

In conclusion I would like to say that the machine tool trade is quite capable of building any machine tools that are required as long as the users will co-operate with them and have a certain amount of patience during the development period. We are on the spot and are in a better position to look after our machines than the foreigner.

MR. P. V. VERNON :—Mr. Engelbach has given us an excellent account of the impressions created by his trip to America so far as the technical and production side is concerned, and when to-day in Coventry I mentioned to some of my friends, who know Mr. Engelbach very well, that he was giving a paper on "The Production Engineer" they said: "Could you ask him to come to Coventry and give another paper on the experiences he had in America that had nothing to do with production?" I do not know whether Mr. Engelbach will take that invitation seriously, but I for one should be very glad if he could.

I cannot help feeling some sympathy with Mr. Engelbach on finding hordes of machine tool makers' representatives on the doorstep, and I think perhaps there might be some disadvantages from his point of view, but nevertheless it shows they were very keen.

On the whole, I feel inclined to agree with nearly everything Mr. Engelbach has said. He has shown up some of our weaknesses, and where I disagree with him is in a very few instances only.

On the question of selling in the U.S.A. Mr. Engelbach seems to think that selling machine tools in U.S.A. is easy. It can be done, but it is not easy. The company with which I am connected has sold machine tools in U.S.A., and I want to say there appears to be no prejudice when you approach, as a Britisher, an American in his country, but you can see all over America a certain amount of prejudice against British tools, and there remains in the background an underlying feeling that the American is rather too polite,

and that he really does not think that an old country like ours can produce anything like their up-to-date and "slap-up" machine tools, but nevertheless good tools can be sold in spite of the fact that the duty on English machine tools in the U.S.A. is 40 per cent. The difficulty is the cost of travelling and selling. America is a large country, and they have got to see the machines; stores and warehouses have to be kept going in order that they can do this, and travelling expenses are enormously high in consequence of the long distances which have to be travelled. Good machine tools *can* be sold in America, but the expenses are so great that the game is hardly worth the candle.

In 1905 I paid a visit to America and saw some most wonderful drop forgings. I have never seen anything in this country quite like them. They were made on "Board" hammers and involved a number of operations. The finishing dies had a separate hammer for each die. The die was placed in the middle of the tup of the hammer. It is considered to be an advantage to have the die in the centre so as to keep the pressure balanced. They used a water spray. The effect of the water spray was to crack the scale so that it flew away. I have spoken to a number of makers of drop forgings in this country, and have enlarged upon the beauty of those drop forgings, but I have never found one who is willing to consider it because they thought so much more of quantity than quality. In England quantities were not considered to be enough to make progressive dies worth while. I do not think the machine tool trade needs defending; whatever defence it needs it has had from Mr. Archdale. He said manufacturers in this country get the machine tools they deserve, and the view we ought to take as machine tool makers is to see that we deserve the customers.

On the question of single-purpose machine tools there are two distinct sides to the question. When purchasing machine tools prospective customers say: "Why don't you make so-and-so?" and "Why don't you build me a special machine?" A fair retort would be: "Why don't you build me a special motor car?" When they say "Why don't you build a Gleason gear-cutter?" "Why doesn't Gleason build a turret lathe?" the question does not need an answer.

I think that if machine tool makers in this country are to progress in all ways at the same rate as American machine tool makers they must have a large market. It does not pay for the most modern machine tool makers to make individual machines; they must be made in fair quantities, and what it comes to is this—that the best machine tools in the future will have to be made in the factory which specialises in them, and special machine tools will be made in factories which specialise in that class of work. To get the same quality they will have to be more expensive, and a customer will have to be prepared to pay the price.

SIR ALFRED HERBERT : Mr. President and Gentlemen, first of all I should like to congratulate you on the launching of your Birmingham Branch and on the very excellent and interesting audience that has come together to-night to hear this very interesting paper.

My feeling about Mr. Engelbach's paper is that it is one which gives food for thought, and that, I think, is what we hope to get from a paper or from a good book. My definition of a good book is not so much one which tells you what to do and furnishes you with the formula for doing it, but one which annoys you, and aggravates you, and makes you think. Criticism, to my mind, is the most valuable thing that anyone engaged in trade can receive, provided it is, as is the case to-night, given in a friendly and helpful spirit. We learn far more from a candid friend who points out our shortcomings and defects than we learn from twenty flatterers who pat us on the back.

The machine tool trade is a very difficult one. I believe it is the most interesting of all mechanical trades, and, so far as I am concerned, I would not change places with a man engaged in any other branch of engineering, even if my income could be multiplied by four. The whole trade appeals to every one of my instincts. It is a sporting trade; the competition is intense. We are not entrenched in a fortress as they are in America—we lie open and unprotected to the competition of the whole world, and still we carry on.

British machine tools, in my experience, cannot be sold in large quantities profitably in America under to-day's conditions. During that sad time when the value of the pound sterling was very low, side by side with the dollar, it was possible, and in some cases easy, to sell machine tools in America, because the difference in the value of the currency very largely discounted the tariff wall, but I do not mind hazarding an opinion that if American machine tool makers in a sporting mood liked to persuade their Government to remove the tariff wall some of them would get a shaking from the importation of British machine tools, even in to-day's state of development.

As Mr. Engelbach said, he was like the man at the piano—doing his best—and I would adopt his own simile, and say that we as machine tool makers, in our own way, are doing our best.

We are conscious of our imperfections, and are very earnest to recognise others that are pointed out to us by our customers. Remember that the customers can be most helpful to the British machine tool maker; in fact, sometimes in my pessimistic moods I say that customers really design our machines for us. Although this is not the complete truth, there is a great measure of truth in that statement.

One of the things I welcome most in Mr. Engelbach's remarks

is his suggestion that users of machine tools should co-operate with makers of machine tools, and that they should put their problems before us and give us the benefit of their experience and advice, and in that direction I believe an immense incentive would be given to the progress of the machine tool trade, which Mr. Engelbach, I am sure, so heartily desires.

I should like to speak for one moment on the subject of the Production Engineer. We hear from those who do not go very deeply into the matter that modern labour-saving machinery kills the brain and reduces the worker to a machine slave. I think those critics very often forget the very large opportunities the introduction of machinery has given to the development of an entirely different class of engineer, whom nobody would have heard about but for this increase in repetition work and automatic machinery.

Until recently where was the Production Engineer—where was the tool setter—where was the skilled charge-hand—the skilled tool-maker? All these classes, I believe, have grown up in comparatively few years, as the direct fruit and the result of the introduction and use of labour-saving machinery.

On the question of education I am afraid I have rather mixed views. When we see what fine Production Engineers exist to-day, and when we ask ourselves what were their special educational opportunities, I think in many cases that their special educational opportunities were practically nil. Surely, the young Production Engineer of to-day, who is going into the world equipped with special university courses, and so on, should go far.

I am one of those old-fashioned people who strongly hold the belief that the main talent which a man possesses is a gift of Providence. You may educate, and you may thereby help, but you will not by any process of education make the uninspired man equal to the one who is keen and energetic in spite of lack of opportunity. You may cultivate a turnip, and make it a larger and better turnip, but you will never cultivate it into a peach.

MAJOR VERNON BROOK :—I am particularly pleased to have this opportunity of getting up and congratulating your President upon his present position, because during the very early part of the war he and I came together in very close personal contact, I on one side as, what I think I may claim to have been, one of the earliest production officers, and he in charge of certain production at the Works, and at that time I recognised in Mr. Hannay someone who had ability which was considerably in excess of that encountered in many other people in a similar capacity.

I think Mr. Engelbach remarked that the term "Production Engineer" was one which was created during the war, and the last speaker has just said that in his days there was no Production

Engineer. I believe the Production Engineer is a war product, and one of those products which has helped to make the industry of this country pluck up courage again and go ahead in a way it would not have done otherwise. If we regard the motor industry of to-day in relation to other industries, it is the one bright spot. The motor industry is exporting more engineering products out of the country than any other, and we may very safely say the Production Engineer has a great deal to do with that.

In my apprenticeship days there were a Works Manager and a Designer, and they were always quarrelling. It seems to me that the duty of a Production Engineer is to act as a *liaison* between those two. Presumably, the Production Engineer of to-day need not be a specialist in one particular branch, but must be a man with a good grounding and able to go into all engineering subjects generally. He must be a man who can get into touch with people inside and outside the Works; he must be able to follow all new developments and take full advantage of them and find out what is coming along. Those of you who are on the sales side will realise and appreciate that even to-day one of the greatest difficulties when you have something good, which you know will help the manufacturer, is to get the manufacturer to appreciate it, but I think, through the medium of the Production Engineer, if he is given his true position in the Works, you will get through ultimately.

I do not think there is any need for me to say anything about the Machine Tool Trade; I am not connected with it; and I think you will agree Mr. Archdale and Mr. Vernon have stood up for it very admirably. When you consider what has been done in other industries in this country in the way of specialised machinery, are we very far behind the U.S.A. in that respect? Take the manufacture of foodstuffs, for instance—chocolate. You will find there highly specialised machinery produced by British engineers, and capable of standing up against any American machinery of whatever kind it may be. It seems to me that the whole question is bound up with the amount of production and the demand, and I believe that British engineers and British tool manufacturers are every bit as capable, and even more capable, of turning out high-grade specialised machine tools than Americans (many of whom employ British designers) when the demand occurs, and that they are able to fulfil that demand at a reasonable profit.

I will not take up your time with saying anything further, but I do again congratulate this Branch on its attendance to-night, and hope such attendance will always be maintained.

Mr. T. S. Catmur then spoke and said he had heard the Paper by Mr. Engelbach with considerable interest, and congratulated

the Birmingham Branch of the Institution of Production Engineers on having such an important and well-attended first Meeting. This was particularly fitting, because eighty years ago the great Institution of Mechanical Engineers was founded in Birmingham itself, with George Stephenson as its first President, and in later years was moved to London. By the appearance of this Meeting, it would seem that the Institution of Production Engineers would particularly flourish, being right in the heart of production.

Referring to Mr. Engelbach's Paper, Mr. Catmur said that he was surprised to hear Mr. Archdale and others take up an attitude as if they were on their defence, either in the prisoners' dock, or, at any rate, as a first witness, because he had listened to the Paper with feelings that a present and a bouquet were being handed to the British Machine Tool Manufacturers, and that really the intent of the Paper was to put some pluck in them.

The true position was that in America they were turning out millions of cars to our few here, and, accordingly, large numbers of Machine Tool Manufacturers were able to specialise on separate types of highly developed high-production machines to reduce shop costs to the British manufacturers, and they would be foolish indeed if they refused to use these machines, which, after all, were worked by British workmen and which produced in weight of output considerably more each month than their own weight.

He was surprised that, notwithstanding that several of the British Machine Tool Manufacturers had undoubtedly reaped the benefit by designing machines on similar lines to some of the American machines, they had paid no tribute to the Americans for the help which they were giving to enable British Motor Car Manufacturers to make their product at low cost and thus to increase their market and compete with the American.

The American Machines were not being sold at a low price, and, while the German Machines were being sold here at £60 per ton and British Machines at £120 per ton, American Machines were being sold at £300 per ton, and it appeared to him that the competition from Germany on the price basis was far more serious to the British Machine Tool Manufacturers than seemed to be imagined.

MR. E. GREGORY:—Most of the remarks seem to be referring particularly to the Automobile Trade and the necessity for Multiple Machines and machines handling large quantities. I have been reasonably fortunate in being employed in the States as a Productive worker, and I think a great deal of their advantage is in the flexibility of the labour, and I do know that in a 3½-year period I had the opportunity of working as a maker of clock instruments for switchboards, and as an operator or fitter-up of centrifugal fans, and, at the same time, machine tool maker,

machine operator, and small tool draughtsman. I do not remember on any occasion being asked what my experience was, but I do remember being asked if I could do the job. More particularly I remember that the opportunities given for a means to the end (which was the dollars) were quite good, and I did not realise, for I never saw—and I worked in fairly large places—that we had very many special machines at all; but I do know that what we did with plain speed lathes in the way of drilling and turning, and so forth, was, to my mind, at that time, very miraculous. We made small quantities, say sixty of a kind, and had a price for doing the job. We were allocated 12 dollars per week until we finished the job, and when we had finished we got the balance. At the same time, we had to progress our own jobs through the shops, and find our stampings, pressings, and other material, get them out, and make them up, and when a man has been engaged on that for several years he gets to own the jigs and fixtures, which may amount to many hundreds of pounds in English money. I think that a great deal of advantage is due to the versatility of the cosmopolitan labour, and that from a machine worker to a Production Engineer is pretty well a matter of two stages, provided a man has the adaptability to handle the job.

AN UNKNOWN MEMBER AT BACK OF HALL :—I think it is absolutely essential a production engineer should be a technical man. For instance, how can a production engineer give times for the production of his work unless he knows that the tool-maker can produce tools in a certain time, and that the hardening process can go through in a certain time. Mr. Engelbach suggests that the last thing a production engineer should be is a technical man. As a matter of fact, I think that one of the big differences between American products and English products is quality. America has a big turnover; but compare American products with English products—motor cars, for instance. In England we have a lot of factories with a very efficient technical staff, and no doubt that technical staff handles the production to a considerable extent; but nevertheless, the resulting products, as all the world knows, are vastly in favour of the English manufacturer. For instance, a very small tool turned out in large quantities by an American firm, *e.g.*, the dot punch and centre punch, very often will not work when you get it—50 per cent. won't work until a technical man has been over them. I do not want to say anything detrimental to the production engineer, but I do think that it is absolutely essential he should have a good grounding in technical matters; for instance, our own production manager is here to-night, so I dare not say too much, but he has come along before now and said he wanted a job put through immediately. Well, that job can be put through, but it will mean that the result will not

be so good, and one may get greater costs in hardening, and perhaps a more brittle result. I will not say any more, as I am a comparative stranger, but I reiterate that a production man to be proficient must have a good technical grounding or, at least, must work in harmony with a technical staff.

MR. HANNAY announced that he had telephoned to a firm in Huddersfield (Messrs. David Brown and Sons) and ascertained that 49 machines had been delivered to the Timken Axle Company in America, and only two months ago two very valuable machines were despatched from Huddersfield.

Mr. Engelbach's Reply.

Before I reply to the others, I must get at that man at the back of the hall. Who in the world suggested that I said a production engineer should not be a technical man? Why, it is the most technical job there is. I only said that he need not learn certain abstruse subjects; but a production engineer has a technique of his own. I did not suggest that he should not have a general training in the first two or three years; but in the fourth year, instead of having an electrical engineer's or sanitary engineer's training, he should have a training applicable to his particular work, which is of very high technique.

Sir Henry Fowler has said that everyone is capable of becoming a managing director, but I am afraid there are not enough firms to go round, which means to say some of us have got to do the hard work. In consequence, it is necessary, in my mind at any rate, to have something to start a career, and I do not agree that production engineering is not a career of its own.

As I said, it is a much more fully recognised technical career in America than in this country, and there is a Muskegon University in Detroit for Production Engineering, and I think that is the answer to Sir Henry Fowler's remark on that subject.

Now for Mr. Archdale. I do not think that he quite appreciated my remarks. He thought that I was criticising, whereas I am only stating a few facts. When he talks about what happened during the war, I thought that was the time when machine tool-makers got their Heaven-sent chance. Sir Alfred Herbert will perhaps know something about that. When we had to make shells and fuses machine tool-makers were in their element. It was at that time everything was sacrificed to get material delivered, and we even had machine tools delivered in war finish.

Our own experience of production estimates is that every guarantee which has been given by America to the English dealer has always been fulfilled; in fact, we do not pay for the machine until it is. As for the question of those guarantees, we put them up in competition, of course, and if we could give all our machine tool orders to the British tool dealers we should do so. For those

of you who are machine tool-makers I want to help you. It gave me quite a shock when I went through my orders the other day to see the enormous number that we have to send abroad. That we shall always have to do so is a prospect I cannot even credit, and I feel I ought to tell you that if you can only do something to help keep these orders in the country I shall be only too pleased.

Mr. Archdale was talking about the question of the capital sum involved in comparison with the work you have to do. We always work on a capital recovery basis. Every machine tool we buy we work out how long it will take us to get our capital actually returned. At present we are working on a 52-week recovery basis. If you can get your money back, that is to say the difference between the cost of the article as it was before, and the cost of the article as it will be, say, in 52 weeks, you have made a good bargain; the worst we have done is 65 weeks. When it comes to the question of time and delivery I am not going to say anything about that!

Mr. Vernon talked about the difficulty of selling; I quite agree it is very difficult. But, on the other hand, quite a number of our friends across the water also have their travelling expenses—first-class saloons, state-rooms, etc.; they do not consider expense, but wait on your doorstep over here and work out in your office layouts, and give sketches—and no man is little paid.

I must not forget to say that I saw a No. 4 Herbert Capstan in Detroit—in a glass case). Here is one of the difficulties; the man that had it said it was one of the best machines, better than any American turret lathe, but he said, "If I sold that machine no American machine tool dealer would deal with me." That is the difficulty; it is not the prejudice of the manufacturer, but a strong selling organisation against you for competitive machine tools.

Mr. Vernon also asks why Mr. Gleason does not make a turret lathe. Gleasons are specialists, and nearly every machine tool-maker over there specialises in the one thing, and progresses more in that line than perhaps we do in this country. Owing to the fact that they get a bigger market they are able to do so, and no doubt this is one of the reasons why, in certain respects, they are better than our own.

Sir Alfred Herbert said customers designed machines for them; that is exactly our trouble. We have to do that designing; we have a lot of other work to do, and I wish the machine tool dealers would do a little more on their own. I am not talking without authority for this. I have always said that there are brilliant exceptions, and you here are brilliant exceptions. Some men can have all the training in the world and not be worth more than £2 per week, and others who have had practically no training at all are worth a lot more.

Major Vernon Brook talked about a Production Engineer being a war product. It was the works manager in my day who did everything, and his principle was to get a drawing which he handed out to the foreman, who handed it out to the man, and said, "Here, Bill, you have got to do this." Well, the fellow could do it. He was a very clever fellow, but all these clever fellows are now jig and tool manufacturers. There are about one million people in Birmingham, and only a small proportion are clever mechanics. These are absorbed in the jig and tool department.

Mr. Catmur talked about American machine tools. I appreciated his remarks very much, and will not say anything more about the Germans copying the American machines. The point that I am trying to get at is the American machines; take an up-setting machine or bolt-heading machine. I can tell you something about those. American machines run from £3,000 to £6,000 each. The German machines are half the price. We wanted one, and I went to two English manufacturers of bolt-heading machines to get one of the required size. In one case I was offered delivery in twelve months at a third more than the American, and in another case delivery in eight months if we would pass the designs of the machine. The German machine was exactly half the price and delivered out of stock. We could not wait twelve or eight months, especially when a machine half the price was at our doorstep. We try our best, but it is a very difficult subject.

Take the big presses. The other day I was talking to an Englishman with a place in Birmingham, and I offered to let him send a draughtsman to our works to make drawings from a big toggle press table and see what he could do. If he could guarantee to make one the same, we would risk it, and if we passed his plan and design we would buy it irrespective of the fact that it might be a little dearer.

I am very delighted to hear that worm gear machines are being sold to America in large quantities by Messrs. David Brown. Is not that exactly what I have been saying? If better machines than the Americans have been sold in large quantities in America, surely you can do the same? Where does the tariff wall come in, or where does the prejudice exist? If it can be done in one case it can be done in another.

Mr. Vernon talked about what happened after hours in America. It had nothing to do with production. On the other hand, I should like to say this. One comes back impressed with the extraordinary courtesy and welcome that an Englishman gets in America; prejudice apparently exists probably in the Press more than anywhere else.

